

## Are Our Coastal Waterways Tidal?

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### ABSTRACT

*Over the past few years I have presented examples of what I call erroneous prior determinations that were a consequence of early survey instructions and regulations making no distinction between tidal and non-tidal waters. I have become increasingly aware that some if not most coastal waterways, including rivers, creeks and estuaries, have been erroneously classified as tidal waterways. The reality is that they are only occasionally open to the influence of tides or at best only open by human intervention, i.e. by works used to maintain shipping channels and safe boating. From public information it is now known that some waterways are cut off from the ocean and tidal influence by sand barriers, and may only be intermittently open by natural processes. This paper discusses whether our coastal waterways are tidal or non-tidal. One example concerns Ettymalong Creek near Umina, which has been surveyed from the time of the grant of surrounding land to recent times for subdivision. The grant survey clearly revealed that a sand barrier existed and that the creek was cut off from the ocean and tidal influence. Subsequent surveys were mixed in the depiction of the creek as being tidal or non-tidal. Another example shows that, based on physical observation and historical aerial imagery, the entrances for Dalhousie, McGraths and Oyster Creeks just south of Urunga are and have been since at least the 1940s barrier creeks that are not open to the ocean. Longshore or littoral drift is a recognised natural movement of sands along the eastern coast of Australia. This sand is deposited in the entrances of waterways when the pressure of water flowing to the coast is that of the ocean building and holding the barrier. Dredging and, for significant entrances, training walls have been required and effected since the early 1900s. Landowners may not enjoy the ownership rights for the adjoining waterways deemed to be tidal. It may also be that landowners' properties have been wrongly burdened by reserves set back from the Mean High Water Mark (MHWM) as at the time of the grant. Intermittently closed and open lakes and lagoons (ICOLLs) are not new, and Section 13.3 of the Crown Lands Management Act 2016 continues to provide the restriction of ownership of land to the banks as at the time of the grant of adjoining land.*

**KEYWORDS:** *Crown lands, land law, tidal waters, lakes, ICOLLs, artificial works.*

### 1 INTRODUCTION

This paper includes a number of extracts from previously published material to indicate that there exists an abundance of resource material to assist in understanding the nature of coastal waterways without the need for undertaking costly and time consuming research. As surveyors it is enough for us to understand and apply, as may be appropriate, the available information to the problem of coastal water boundaries.

The 'natural' boundaries for lands abutting waterways are either tidal or non-tidal as a consequence of the tidal nature of the waterway as at the time of the initial (grant) survey. The

title boundary, either Mean High Water Mark (MHW) for tidal waters or bank for non-tidal waters, cannot change over time even though the actual physical tidality of the waterway may change. By observation of survey plans on public record it is apparent that there are a number of situations where this principle has not been maintained. The example in section 3.2 shows that surveys for Ettymalong Creek have not been consistent over time.

The surveying regulations prior to 1882 did not distinguish between tidal and non-tidal waters, and there was no rule to guide surveyors in how to determine the position of MHW. In Thompson (2016) these regulations were erroneously referred to as those issued in 1886. Consequently, surveys prior to 1882 appeared to depict both tidal and non-tidal waterways with the uni-directional arrow indicating water flow downstream. Land titles constructed from these surveys were therefore flawed in referring to land as bound by the waterway or bank of such.

Thompson (2016) also included the example of the Macleay River and Spencers Creek where issues concerning the ownership of the beds of the waterways were raised. The example in section 3.2 again concerns the Macleay River system and doubt as to historical tidality and consequently the location of property boundaries and ownership of the beds of this waterway.

The doubt about waterway tidality is not unique to New South Wales (NSW), however the extent of the potential error in classifying waterways may be specific to the geographical location of the NSW coastline and probably also the coast of Eastern Australia. In relation to property boundary movement (accretion and erosion), there are a mix of causative forces including natural processes and human interference (Flushman, 2002). By observation, it has become apparent that the progression of sand, i.e. the process of littoral (longshore) drift, along the Eastern Australian coast has and continues to build sand barriers at the entrances to many coastal waterways. These barriers are recognised as being navigational hazards and artificial works, including channel dredging and training walls, have been employed as deemed necessary for maritime safety purposes. As stated on internet websites and publications jointly by NSW & QLD Governments (2019) for the Tweed Sand Bypass Project, ocean swells from the south-east push sand (in the ocean) to the north along Australia's east coast – this is called longshore drift. This drifting sand is needed to build up beaches, especially after storms, but the drift can be interrupted by natural or man-made structures.

The investigation processes for the examples detailed in this paper differ according to the purpose and available information. The case that precipitated the recognition of erroneous classification of waterways used rigorous examination of an actual application with survey plans and supporting evidence as well as additional reference materials sourced to gain a historical perspective of the waterway and its tidality. The other cases have been more basic investigations using title survey plans either alone or together with historic aerial imagery.

The investigations in the few locations detailed in this paper suggest that natural coastal processes have most likely been affecting the entrances of many NSW coastal waterways since before European settlement. As a result, from a property boundary perspective, these waterways are not naturally tidal as a consequence of entrance barriers that prevent or restrict tidal inundation. These waters are in actual fact intermittently open and closed lakes and lagoons (ICOLLs), and titles to lands bordering these waters are not limited by MHW but rather the bank that is fixed in the position when initially surveyed for title purposes. This re-classification of the waterways affects the titles in that there is no accretion or erosion, the ownership of the beds is Crown land that is held in the name of the State of NSW and where Crown 30.48 m

reservations were created upon granting of lands, these are likely invalid as a consequence of the waters not having being tidal at the time of the grant.

Resource materials used in the investigations presented in this paper include publicly available books, journal articles, conference proceedings, technical reports, survey plans and titles from public record and historical aerial imagery. A glossary of relevant terms is included to ensure that there is certainty about the meaning and consistency in the usage of all the terms used in this paper.

## 2 BACKGROUND

Cadastral surveyors who undertake surveys for lands involving water boundaries have a responsibility to thoroughly investigate the titles of the subject lands and the relevant property rights for adjoining lands that may be affected in the survey. In addition, they need to be cognisant of applicable legislation and other relevant reports and publications. These may include:

- Surveying and Spatial Information (S&SI) Regulation for boundaries formed by tidal and non-tidal waters and other natural features. By the definitions included in the regulations, a lake includes any permanent or temporary lagoon or a similar collection of water not contained in an artificial work, but does not include tidal waters. If, since the date of a previous survey, there has been a change in the position of the bank of a lake forming a boundary of land to be surveyed, then, in any subsequent survey, the position of the bank, as it was before the change, must be adopted.

The definition in the S&SI Regulation may need legal clarification to understand the phrase “but does not include tidal waters”. The following extract from Moore (1968) adds to the potential for uncertainty: “The facts that the waters of a lake are salt, and that when the channel is open there is a certain degree of communication with the ocean are not sufficient to make the lake an inlet of the sea within the meaning of the law. That is called an arm of the sea, says Sir Matthew Hale where the sea flows and reflows and so far only as the sea so flows and reflows. In applying this test to the facts of any case it is essential to have regard to the character of the waters in question. For instance, if a lagoon were subject to the ebb and flow of the tide for three hundred and sixty-four days in the year, I apprehend that it would be held to be an inlet of the sea, although it was closed to the sea by a sand-bar on one day of the year. Taking the opposite extreme, if the lagoon was closed to the sea three hundred and sixty-four days in the year and open one day only, I apprehend it would not be an inlet of the sea. The Court, in my opinion, must look at all the facts in each case, and, therefore, every case must stand on its own circumstances. In *Merewether’s case*, Simpson C.J. (in Eq.) held that the lagoon in question was not an inlet of the sea within the meaning of the grant, and that consequently a reservation of one hundred feet above high-water mark did not apply.”

- Section 13.3 of the Crown Lands Management Act 2016 that refers to entitlements over land with boundaries to lakes and rivers. This is a revision of Section 172 Crown Lands Act 1989 and Section 235A Crown Lands Consolidation Act 1913, both now repealed. The definition of a lake in this section differs with the S&SI Regulation in that it does not include the phrase “but does not include tidal waters” as can be seen in (3) below. In part, section 13.3 states that:

- 1) The boundary of any land that is transferred by the Crown and is described or transferred in either of the following ways is taken to be the bank of the lake at the time of the Crown survey for the purposes of the transfer:
  - a) as bounded by, by reference to or by the margin or bank of, a non-tidal lake,
  - b) by metes expressed or shown to run to a lake or to the margin or bank of a lake.
- 2) Title to land comprising the bed of a non-tidal lake does not pass, and has never passed, by any transfer of land adjoining the lake:
  - a) as bounded by, by reference to or by the margin or bank of, the lake, or
  - b) by metes expressed or shown to run to the lake or to the margin or bank of the lake.

Also, the owner of land transferred in that way is not entitled to any rights of access over, or to the use of, any part of the bed.

- 3) The doctrine of accretion does not apply, and never has applied, to a non-tidal lake. In this section, bank means the limit of the bed of a lake or river, and bed means the whole of the soil of a lake or river including that portion:
  - a) which is alternately covered and left bare, with an increase or diminution in the supply of water, and
  - b) which is adequate to contain the lake or river at its average or mean stage without reference to extraordinary freshets in time of flood or to extreme droughts.

Lake includes a permanent or temporary lagoon or similar collection of water not contained in an artificial work. River includes any stream of water, whether perennial or intermittent, flowing in a natural channel, and any affluent, confluent, branch or other stream into or from which the river flows.

- Section 28 of the Coastal Management Act 2016, which refers to the modification of doctrine of erosion and accretion and is in lieu of Section 55N of the Coastal Protection Act 1979 (repealed). This section applies to land with a boundary which is defined or otherwise determined by reference to a MHWM. As a consequence of Section 13.3 (3), this legislation may not apply to all the waterways classified as tidal waters.
- Regulations for Guidance of Surveyors 1882, Clause 44. On creeks, estuaries, or waters subject to tidal influence, land being the foreshore cannot be alienated beyond high-water-mark, unless under special conditions as prescribed by law; but where high-water-mark is doubtful the boundaries of the land measured shall be right lines following approximately such high-water-mark. High-water-mark shall be defined as the mean high-tide mark between high-water spring and high water neap tides. This appears to be the first of the Regulations for surveyors in NSW that stipulates the definition of the MHWM boundary.
- Government orders relating to surveys, e.g. No. 26 Aug 21 1828 – “The government will further reserve to itself all land within 100’ of the high water mark (HWM) on the seacoast, creeks, harbours and inlets.” This order is of interest as a consequence of the time delay to the regulation of the definition of the MHWM boundary.
- Surveyor General’s Direction No. 6 (Water as a Boundary) (DFSI Spatial Services, 2016). Section 2 provides the definition of a lake the same as by the Crown Lands Management Act 2016. Section 4.1 concerns non-tidal waters, i.e. lakes and lagoons. Narrabeen Lagoon, Dee Why Lagoon, Glenrock Lagoon and Lake Illawarra are water bodies that have been judged to be non-tidal. The doctrine of accretion and erosion does not apply to land adjoining those water bodies. There may be other non-tidal water bodies within NSW that by virtue of their

character may be deemed non-tidal. Similar statements were also recorded in Willis (1982), first published in 1945, Hamer (1967) and Moore (1968).

- Registrar General's Guidelines (LRS, 2019).
  - 1) Tidal lakes: It is doubtful whether there are any lakes in NSW, which have perceptible tides, the so called tidal 'lake' (e.g. Lake Macquarie) actually being an inlet of the sea. Most coastal lakes or lagoons have, at one time or another, been closed off from the sea and accordingly are classified as non-tidal. The following coastal lakes or lagoons in this State have been considered by the Courts to be non-tidal:
    - a) Narrabeen Lagoon (State Report Vol. 45, page 321)
    - b) Dee Why Lagoon (Commonwealth Law Report Vol. 10, page 341)
    - c) Lake Illawarra (State Report Vol. 21, page 408), the court ruling affects part of the lake and a tributary
    - d) Glenrock Lagoon (State Report Vol .5, page 157)
  - 2) Non-tidal lakes and lagoons: When a plan of survey includes a boundary fronting non-tidal lake or lagoon waters, the line of the bank that constitutes that boundary should be examined by the surveyor by comparing it by plot with the boundary as defined by the Crown survey. If the comparison discloses no more than minor variations in position, the definition will be accepted by NSW Land Registry Services (LRS). If variations of any significance are evident, the surveyor must adopt the original line of the bank, as pursuant to Section 172 Crown Lands Act 1989 (formerly Section 235A Crown Lands Consolidation Act 1913, now repealed), the doctrine of accretion and the "ad medium filum" rule does not apply and is deemed never to have applied to non-tidal lakes.
- Hallmann (2007):

Chapter 13.57 – Coastal lagoons that are only intermittently open to the sea or affected by the tides are, by common law, non-tidal and thus do not attract the reservation (30.48 metre (100 feet) reservations from high water mark):

  - 1) A-G v. Merewether (1905): In Merewether's case, a grant issued in 1840 reserving all land within 30.48 m of high-water mark, the land was bounded in part by a small lagoon, Glenrock Lagoon, and a creek which emptied into it. The Crown sought to establish that the 30.48 m reservation was effective along the banks of the lagoon and the creek. It was held that the lagoon was not a tidal inlet of the sea, consequently there was no reservation operating in favour of the Crown. The finding was based on the following facts:
    - a) the condition of the lagoon had continually changed;
    - b) the lagoon was more or less permanently separated from the sea by a sand bar;
    - c) a channel was often made when the lagoon filled up, whether artificially or naturally;
    - d) this channel soon closed up when the water had run out;
    - e) the sea flowed into the lagoon when the channel was open;
    - f) before 1880 there was rarely any inflow from the sea except by waves lapping over the bar at high tides in heavy weather;
    - g) the water in the lagoon was salt, at least at the end nearest the sea;
    - h) the lagoon was less exposed to the entrance of the sea in recent years;
    - i) the lagoon was not subject to the ordinary ebb and flow of the tides.
  - 2) A-G v. Swan (1921): In Swan's case, a Crown grant issued in 1840 for land fronting Lake Illawarra and Mullet Creek which flowed into it, subject to a reservation of all land within 30.48 m from high-water mark. The Crown sought to establish that this reservation was effective along the boundary of both the lake and the creek. It was held,

however, that Lake Illawarra and Mullet Creek were not tidal inlets of the sea within the meaning of the grant, in as much as Lake Illawarra was only intermittently open to the sea, including the period at the time of grant, and could not therefore be said to be subject to the regular ebb and flow of the tides; and there was, in fact, no daily visible rise and fall of the tide in the Lake or in Mullet Creek.

Chapter 13.58 – As the position of the bank or shore of a lake or lagoon or of streams emptying into them in relation to the owner's property is of considerable importance to the owner, the surveyor has to be particularly careful to examine the history of the lake or lagoon in relation to the sea and its tides before assuming the water to be tidal.

3) State Reports NSW: Attorney General (NSW) v. Wheeler (1944) 45 SR (NSW) 321 – Narrabeen Lagoon. This case was primarily concerned with land situated between Pittwater Road and the western side of the lagoon. It was accepted that the lagoon was a waterbody disconnected from the sea as follows: "Narrabeen lagoon is non-tidal. It was, as a rule, closed to the sea by a sand bar, but at times when the water of the lagoon had risen to a height of 4.87 feet, the bar was opened by employees of the local Shire Council before the establishment of the Council the bar had been on occasions opened by fishermen, by employees of the Public Works Department, and others, or it had been forced by the pressure of water and wind."

4) Sloane (1989): Williams v. Booth (1910) 10 CLR 341 – Dee Why Lagoon. By Crown Grants issued in 1819 and 1834, the Crown granted to the plaintiff's predecessors in title two adjoining parcels of land, which were separated by a salt water lagoon, situated near the sea. The boundaries of the land granted, so far as material, were described as, in the one case, "to a salt water lagoon and on all other sides by that lagoon and sea" and in the other case "to Dewy Lagoon, on north by that lagoon to the sea". The lagoon was separated from the sea by a sand bar. At certain seasons and tides there was an open channel between the lagoon and the sea, through which the tide ebbed and flowed, while at other times the channel was closed by the sand bar, until the waters of the lagoon, being swelled by rain, cut through the bar and restored communication with the sea. Prior to 1860 the channel was more often open than closed, but in recent years it had been more often closed than open.

Held that having regard to the subject matter of the grant and the description of the boundaries, it was the intention of the parties that the land granted should not extend beyond the margin of the lagoon, and that this intention being clearly expressed, the then actual nature and condition of the lagoon was immaterial. Held also that the "ad medium filum" rule is not applicable to marine lagoons, and that if it were so applicable, the fact that such lagoons are substantially part of the sea and may be of public use for purposes of fishing and navigation would exclude the application of the rule in the present case. Held further, that even if the channel were now permanently closed to the sea, no case of accretion had been made out, and any addition to the soil of the grantee directly caused by each closure could not have been imperceptible.

- NSW Office of Environment and Heritage (NSW OEH): Correspondence from Estuaries and Catchments Science officers to K. Thompson (received by email in April 2017). The responses received were very useful in understanding the nature of changes associated with these coastal waterways. The application of the classification 'science' to the property boundary aspects is beyond that required for survey purposes. The following is a transcript of some of the responses.

"The term ICOLL is very loosely applied and does not have a clear definition, leading to confusion in its application. In NSW there are two primary estuary typologies, the geographical/geological approach and the functional approach. The approach used by OEH

considers tidal flushing time which is a function of estuary entrance condition (i.e. open/closed) and propensity to store or discharge water from the catchment as the two determinants of type.

NSW OEH uses the typology which recognises the following estuary types:

- a) Drowned river valley: deep open entrance, large volume/surface area;
- b) River estuary: linear estuary with wave dominated entrance but usually open, closes rarely;
- c) Lake: large non-linear estuary with wave dominated entrance, but usually open, closes rarely;
- d) Lagoon Type A (lagoon): small non-linear estuary with wave dominated entrance that closes at times;
- e) Back dune lagoon: small non-linear estuary with wave dominated entrance that closes at times, groundwater fed, unique ecology (sub type of Lagoon);
- f) Creek (Lagoon Type B): small linear estuary with wave dominated entrance that closes at times.

NSW OEH has identified 184 estuaries and classified each one according to this typology (Figure 1). Lagoons, creeks, back dune lagoons and some lakes and rivers could all be classified as ICOLLs, but without a clear definition of ICOLL it is not a useful term for classification or management.”

- Technical reports and journal articles: For example, Haines and Thom (2007) state that within Australia, wave-dominated barrier estuaries and coastal lagoons that are intermittently connected to the ocean have been termed Intermittently Closed and Open Lakes and Lagoons (ICOLLs). ICOLLs are relatively abundant on the south-east coast of Australia and NSW in particular. ICOLLs in NSW have evolved by marine sands forming a barrier across natural coastal inlets and bedrock embayments when sea level stabilised some 6,000 years ago. For approximately 70% of the larger ICOLLs, the barrier has completely enclosed these embayments, preventing regular tidal interaction with the ocean (i.e. they are mostly closed). For ICOLLs that are mostly closed to the ocean, catchment rainfall and associated runoff results in increasing water levels until levels reach the crest of the entrance sand berm. Once the sand berm becomes overtopped, high velocity outflows cause scour and rapid channelisation. Discharge from the ICOLL continues to enlarge the entrance channel until the lagoon attains a comparable water level to the adjacent ocean. This can be further exacerbated by storm wave erosion cutting into the entrance berm on the ocean side. The resulting ‘open’ entrance allows tidal exchange between the ocean and the lagoon until marine sands, reworked under the action of tides and waves, once again infill the channel.

Estuary	Metric	Entrance condition	Dominant condition	Response classification	Subclass
Tweed River		O/T	O	RIVER	BARRIER RIVER
Cudgen Creek		O/T	O	RIVER	BARRIER RIVER
Cudgera Creek		O	O	RIVER	BARRIER RIVER
Mooball Creek		O/T	O	RIVER	BARRIER RIVER
Brunswick River		O/T	O	RIVER	BARRIER RIVER
Belongil Creek		I	C	LAGOON	CREEK
Tallow Creek		I	C	LAGOON	LAGOON
Broken Head Creek		I	C	LAGOON	LAGOON
Richmond River		O/T	O	RIVER	BARRIER RIVER
Salty Lagoon		I	C	LAGOON	LAGOON
Evans River		O/T	O	RIVER	BARRIER RIVER
Jerusalem Creek		I	C	LAGOON	LAGOON
Clarence River		O/T	O	RIVER	BARRIER RIVER
Lake Arragan		I	C	LAKE	LAKE
Cakora Lagoon		I	C	LAGOON	LAGOON
Sandon River		O	O	RIVER	BARRIER RIVER
Wooli Wooli River		O/T	O	RIVER	BARRIER RIVER
Station Creek		I	C	LAGOON	LAGOON
Corindi River		O	O	RIVER	BARRIER RIVER
Pipe Clay Creek		I	C	LAGOON	CREEK
Arrawarra Creek		I	C	LAGOON	LAGOON
Darkum Creek		I	C	LAGOON	CREEK
Woolgoolga Lake		I	C	LAGOON	LAGOON
Flat Top Point Creek		I	C	LAGOON	CREEK
Hearns Lake		I	C	LAGOON	LAGOON
Moonee Creek		O	O	RIVER	BARRIER RIVER
Pine Brush Creek		I	C	LAGOON	CREEK
Coffs Creek		O	O	RIVER	BARRIER RIVER
Boambee Creek		O	O	RIVER	BARRIER RIVER
Bonville Creek		O	O	RIVER	BARRIER RIVER
Bundageree Creek		I	C	LAGOON	CREEK
Bellinger River		O/T	O	RIVER	BARRIER RIVER
Dalhousie Creek		I	C	LAGOON	LAGOON
Oyster Creek		I	C	LAGOON	LAGOON
Deep Creek		I(O)	C	LAGOON	LAGOON
Nambucca River		O/T	O	RIVER	BARRIER RIVER
Macleay River		O/T	O	RIVER	BARRIER RIVER
South West Rocks Creek		O/T	O	LAKE	LAKE
Saltwater Creek (Frederickton)		I	C	LAGOON	LAGOON
Korogoro Creek		O	O	RIVER	BARRIER RIVER
Killick Creek		I	C	LAGOON	LAGOON
Goolawah Lagoon		I	C	LAGOON	LAGOON
Hastings River		O/T	O	RIVER	BARRIER RIVER
Cathie Creek		I(O)	C	LAGOON	LAGOON
Duchess Gully		I	C	LAGOON	CREEK
Camden Haven River		O/T	O	LAKE	LAKE
Manning River		O/T	O	RIVER	BARRIER RIVER
Khappinghat Creek		I	C	LAGOON	LAGOON
Black Head Lagoon		I	C	LAGOON	CREEK
Wallis Lake		O/T	O	LAKE	LAKE
Smiths Lake		I	C	LAKE	LAKE
Myall River		O	O	LAKE	LAKE
Karuah River		O	O	RIVER	BARRIER RIVER
Tilligerry Creek		O	O	LAKE	LAKE
Port Stephens		O	O	LAKE	DROWNED VALLEY
Hunter River		O/T	O	RIVER	BARRIER RIVER
Glenrock Lagoon		I	C	LAGOON	CREEK
Lake Macquarie		O/T	O	LAKE	LAKE
Middle Camp Creek		I	C	LAGOON	CREEK
Moonee Beach Creek		I	C	LAGOON	CREEK
Tuggerah Lake		I(O)	C	LAKE	LAKE
Wamberal Lagoon		I	C	LAKE	LAKE
Terrigal Lagoon		I	C	LAGOON	LAGOON
Avoca Lake		I	C	LAGOON	LAGOON
Cockrone Lake		I	C	LAGOON	LAGOON
Brisbane Water		O	O	LAKE	LAKE
Hawkesbury River		O	O	LAKE	DROWNED VALLEY

Figure 1: Part of the OEH NSW Estuary Characteristics spreadsheet (O – open, C – closed, I – intermittent, T – trained).

### 3 CASE STUDIES

#### 3.1 Tuggerah Lakes

An application for approval of the position of the MHW boundary of a property at Toukley adjoining Budgewoi Lake was submitted consistent with the requirements of the Surveying and Spatial Information Regulation 2012. Public records including parish maps, Crown surveys, land titles and subdivision surveys usually depict the waters of the Tuggerah Lakes south of Budgewoi as tidal. Some historical editions of the parish maps did not show the tidal status.

The application was to claim accretion and was supported by a comprehensive report and additional information as necessary for the site. A report by the Manly Hydraulics Laboratory (MHL) was included for the determination of the height of mean high water. This report was different from the normal style of advice; it was in itself quite comprehensive and indicated that the height of mean high water (MHW) was not able to be calculated in the normal manner.

As a result of the MHL report, it was necessary to investigate further the nature of the Tuggerah Lakes system. An abundance of material has been found to substantiate the fact that the lakes system is or has been separated from the ocean. Figure 2 is a tabular timeline outlining changes in Tuggerah Lakes, showing repeated closures and dredging events since 1883 (Scott, 2002).

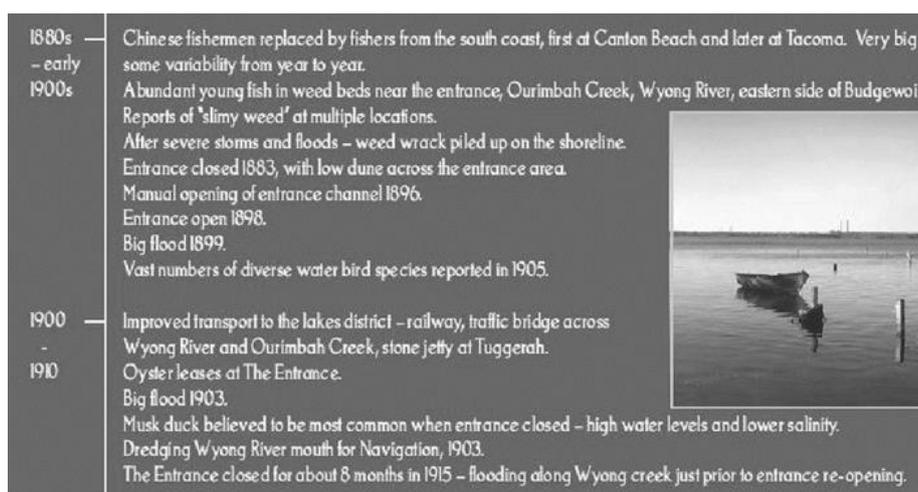


Figure 2: Time and tide changes in Tuggerah Lakes (Scott, 2002).

Other reference material used in the investigation that identifies the Tuggerah Lakes system as being separated from the ocean included information on how Tuggerah Lakes work, the Tuggerah Lakes Estuary as a unique environment, and an estuary management study summary from 2005 (Central Coast Council, 2019), as well as estuary statistics (NSW OEH, 2019).

Scott (1998) states that the only connection between the lakes and the ocean is a small channel at The Entrance. This results in a restricted interchange of water between the lakes and the ocean, and very little tidal effect. The channel is in a continuous state of change due to the deposition and subsequent erosion of various sandbars and spits. The channel is now kept permanently open by continuous dredging of the sand bars that slowly build up across it. Under natural conditions, the channel would slowly block up and could remain closed for up to a year or more. Eventually a large flood would burst over the sandbars and scour out the channel.



Etymalong Creek is depicted by CP N33~2111 that was completed in August 1872 (Figure 4). This plan clearly shows sand as a probable bar to surface water flow to the ocean. Despite the name indicating a creek, it was most likely closed from the sea and as such a lagoon. This is also the same by CP 3434~2111 being the survey for the Crown reserve east of Portion 52. Old investigation files report that the creek had been classified non-tidal and that the adjoining landholders enjoy presumptive title to the middle thread of the creek.



Figure 4: Part of Crown plan N33.

An application was received for the approval of the water boundary as shown on a plan of redefinition of land being a lot within a subdivision of part of Portion 52. The proposal was that the title extends to the centreline of the creek. This was contrary to the notation on the current title plan dated January 1991, which stated that the boundary was the MHW.

An earlier subdivision (DP11184) dated August 1919 (Figure 5) has no such notation and shows the creek as the boundary together with an arrow to indicate the direction of flow towards the ocean, this being the convention for non-tidal streams.

The plan records for the lands near the ocean entrance of the creek are confused in regard to tidal or non-tidal with recent surveys depicting a boundary to MHW. It is apparent that a sand barrier at the ocean entrance has been depicted for many plans since the original grant survey.

Etymalong Creek was in fact a lagoon and as such the extent of all adjoining titles is the bank and no part of the bed is attached to those lands. Unfortunately, mistakes have been made and title redefinitions have been for some to the MHW and others to the banks and all have included parts of the bed as defined by the early surveys. Consistent with the concluding remarks for the Tuggerah Lakes example (section 3.1), redefinition surveys should maintain the current title water boundary positions with no change into the future.

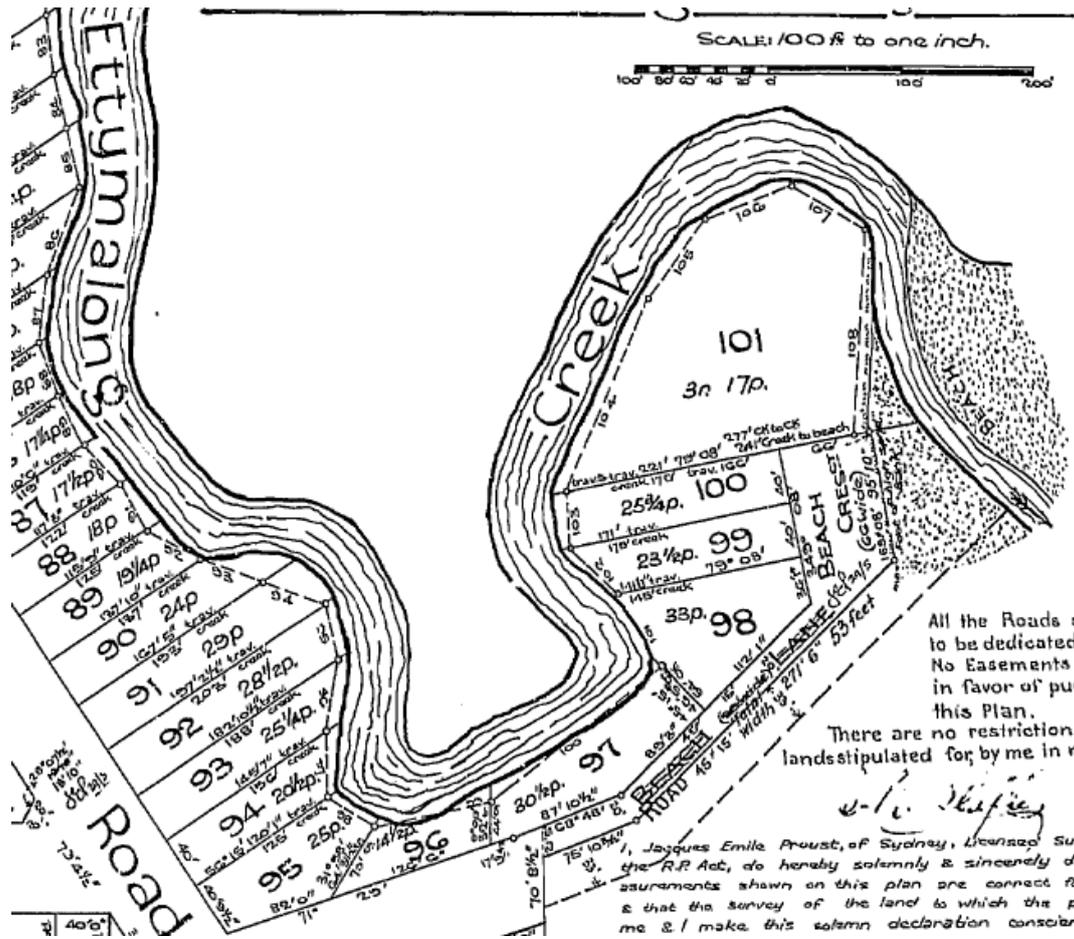


Figure 5: Part of DP11184.

### 3.3 Creeks near Urunga

An area of Crown land involving approximately 20 parcels along the coast south of Urunga was subject to Native Title and Aboriginal Land Claims. Survey advice was requested to enable negotiations between all relevant parties for the subdivision of the lands with boundaries set to satisfy the needs as justified by the parties. Consideration of the claims for the land determined that most of the land would be granted as Aboriginal Land Claims and the creeks within the area would not be transferred but retained for the public. As such, the creeks would form the boundaries for parcels abutting the creeks. Easements were also to be created along the waterways and coastal beach area. The coastal limit (boundary) for title purposes is the MHWM of the South Pacific Ocean.

During a site visit in 2017 together with representatives of the various parties, it was observed that Dalhousie Creek at the northern end of the site was separated from the ocean by a sand barrier of considerable size. In addition, at the southern end of the site, McGraths Creek that ‘flows’ south and Oyster Creek that ‘flows’ northward, join to form a single channel that would connect to the ocean if there was no barrier at the entrance. Figures 6 & 7 show the barrier entrances to the creeks.

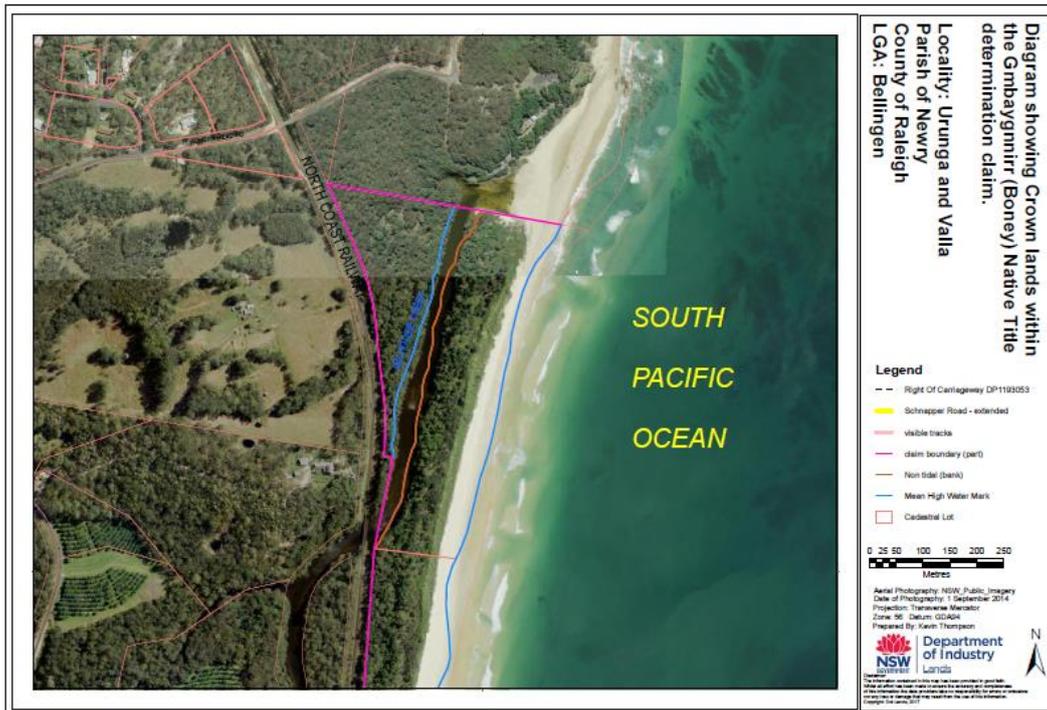


Figure 6: Part of Dalhousie Creek, showing barrier at entrance to ocean.

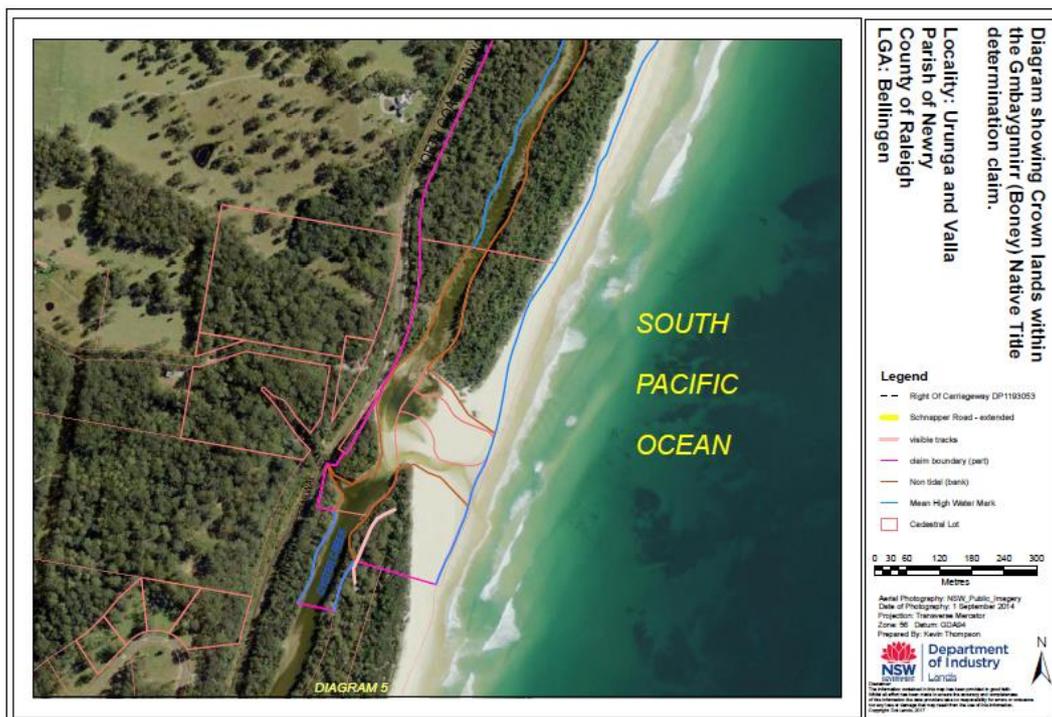


Figure 7: Barrier at ocean entrance for McGraths and Oyster Creeks.

While much of the land is unsurveyed Crown land, there are portions that were surveyed for titling purposes in the mid-1900s. These surveys where parts of the above creeks formed boundaries were mixed, some parts were considered tidal with the MHWm shown as the boundary while other parts were considered non-tidal with the creek banks depicted as the boundary. The Crown plans shown in Figures 8-10 are provided to show the variances.



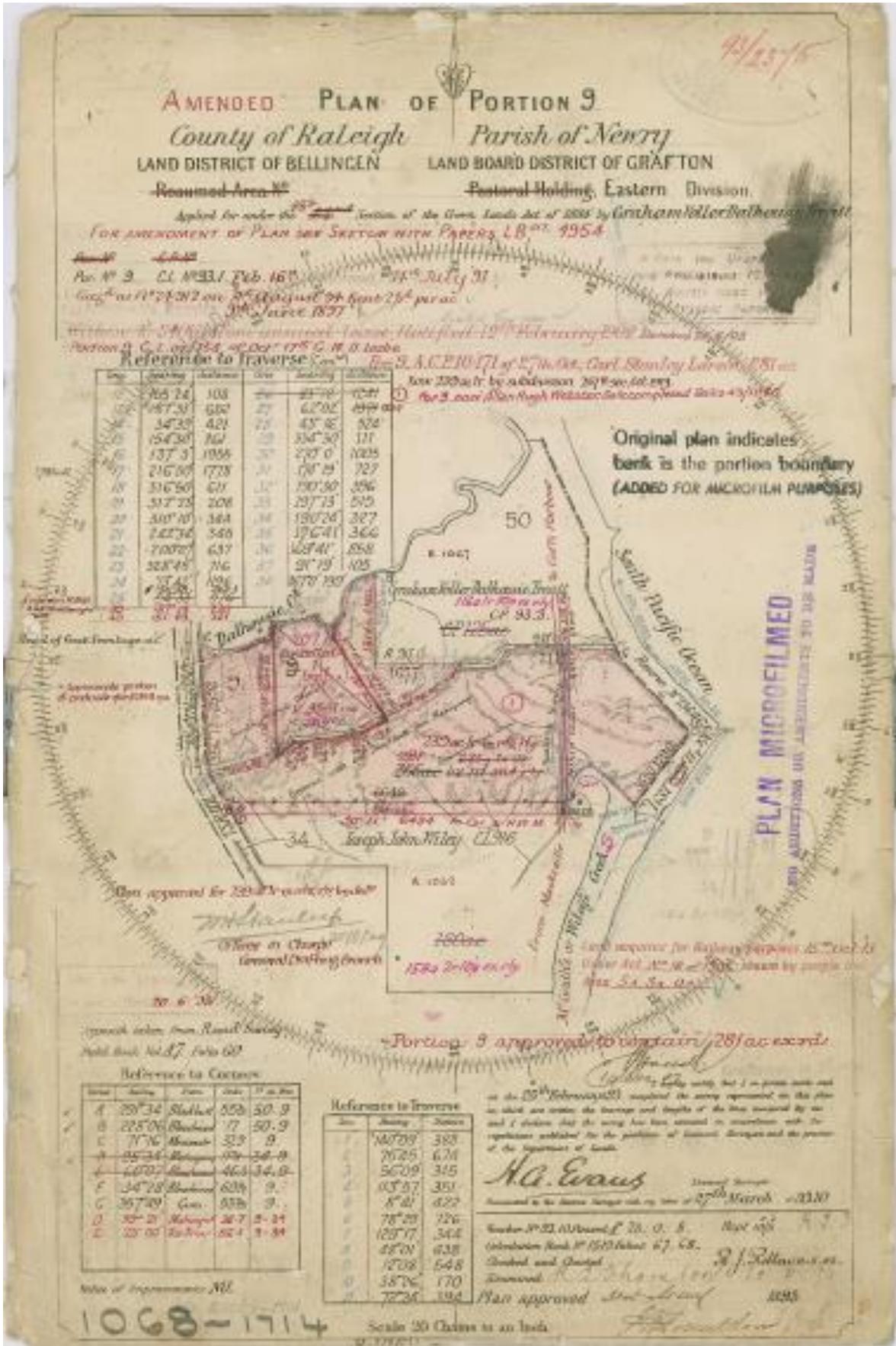


Figure 9: CP 1068~1714.



A search of historical aerial imagery revealed that the creeks have been separated from the ocean by sand barriers since the 1940s (Figure 11).



Figure 11: Historical aerial imagery of Bowra - Nambucca: (a) Dalhousie Creek (SVY 587 #56813), and (b) McGraths and Oyster Creeks (SVY 587 #56870).

While a rigorous investigation was not undertaken at the time, there is sufficient evidence combined with the available geological and geomorphological information to support the concept of these creeks being ICOLLs. During storm events or flooding, the beach berm may wash away allowing tidal influence to resume within the waterway, but only until the berm reforms and stops the tidal flow. For survey and title purposes these ICOLLs are considered to be non-tidal. The tidal regime for waters can change over time mainly because of human interference including siltation due to remote developments. The title ‘tidal’ status should remain the same as when it was initially surveyed. Where the lands are yet to be alienated, the initial survey should extend to the banks only.

### 3.4 Macleay River

Properties along the Macleay River have been subject to Crown Lands investigation with regard to the positions of the MHWL boundary. A search of public information has revealed that the mouth of this river was affected by a sand barrier. However, with the force of flood waters and subsequent human actions, the position of the mouth was relocated some kilometres south where it has remained with the construction of training walls.

Tourist information at South West Rocks states that typical of NSW coastal settlements, shipping was the preferred mode of trade and transport in the early days of colonisation. The economy of NSW was reliant on safe ocean transport of people, goods and supplies. Originally the mouth of the Macleay River was at Grassy Head, but this entrance was closed by flood in 1893. The new entrance at South West Rocks is a man-made channel constructed between 1896 and 1906.

The character of the river, particularly the entrance and bar, is outlined in Munday (2011), based on various sources including newspaper articles from the mid to late 1800s and the report by

Sir John Coode to the NSW Legislative Assembly dated 25 May 1891 entitled *The Parliamentary Standing Committee on Public Works, Harbour Works at Macleay River, 1898*. Munday (2011) has shown the river and the Hastings and Manning to be affected by barriers at their entrances to the ocean. Since 1864 the Macleay River had formed entrances in several positions between Grassy Head and South West Rocks. The positions of the entrances varied considerably, dependent on the forces and direction of the sea and the flow of the river. Following the flood of 1864, a public meeting determined that steps were needed to dredge the river, and also the Clarence and Richmond Rivers. At the time, dredging was considered to be likened to maintaining country roads; without the dredging the river silted up. The then Department of Public Works committed to the works even with the use of its own sea dredge. A historical description of the Macleay River is also contained in Telfer (2005), which is part of the information required for the preparation of the Estuary Management Plans.

The following excerpts from the Department of Public Works annual report for 1897 (Public Works, 1898) demonstrate the involvement of the NSW Government in human interference for maritime safety, of the natural boundaries of lands adjoining coastal waterways (see also Figure 12):

- “The various schemes for the improvement of the entrances to the seven principal northern rivers, by means of the construction of guide-banks, training walls and breakwaters, have made good progress during the year.”
- “Satisfactory progress was made in extending the various training walls at the entrances to the Bellinger, Nambucca, Macleay, and Manning Rivers. The breakwater designed to form a harbour of refuge at Trial Bay has been extended a further distance of 60 feet, making the total length now constructed 600 feet, out of a proposed ultimate length of 2,000 feet. The average number of prisoners employed on this work was 116, and the year’s expenditure amounted to £4,331.”
- “It is scarcely necessary to point out here that the improvement of these rivers, by making them serviceable and convenient for purposes of navigation, is a matter of vital importance in the development of the Colony. They form the natural highways of some of the richest and most fertile portions of the Colony and for many years to come must constitute almost the sole outlets for the trade and commerce of the Northern districts. The moneys expended on their improvement may fairly be considered as analogous to the large amounts yearly spent on the construction and maintenance of roads in the other parts of the Colony.”
- “In order to more expeditiously deal with the shallow bars existing at most of the Northern River entrances, the Department has now in course of construction on the Clyde, Scotland, a twin-screw dredge of 700 horse-power, designed to load herself when steaming slowly over bars, and to draw when laden, not more than 5 feet, yet powerful enough to contend with heavy seas. This vessel will carry on the work of deepening the river entrances by means of a suction pump worked while she is slowly steaming in or out over the bar; the spoil will then be deposited at sea or some other suitable place. Judging from American experience with a similar kind of dredge, this new vessel should prove a valuable addition to our existing dredge plant.”
- Macleay River, New Entrance: “The new channel was dredged to a depth of 10 feet at low water, or an average of about 14 feet depth of excavation, over an area of 10.7 acres; length of channel 2,000 feet by 250 feet wide. South Wall – 447 feet of this wall was made with 15,587 tons of stone. North Wall – 457 feet was constructed and 1,980 feet of facing was completed on north bank. This, with the stone deposited on north side for future use, took 41,025 tons of stone. The expenditure to date was £9,452, or 3s. 0.75d. per ton on the 57,212 tons deposited. Twenty-five tip trucks were built, locomotive got ready for work, and a shed erected for it. The bar has not improved much yet but all the steamers use this entrance,

portion of their cargo being however transhipped into droghers under the shelter of the Trial Bay Breakwater. The average depth on the bar at low water has been 3 feet 9 inches. A wharf is in course of construction at the end of South Training-wall, and is nearly completed, its dimensions are 50 feet by 15 feet. A new wharf was erected at Summer Island on the Macleay River at a cost of £216.”

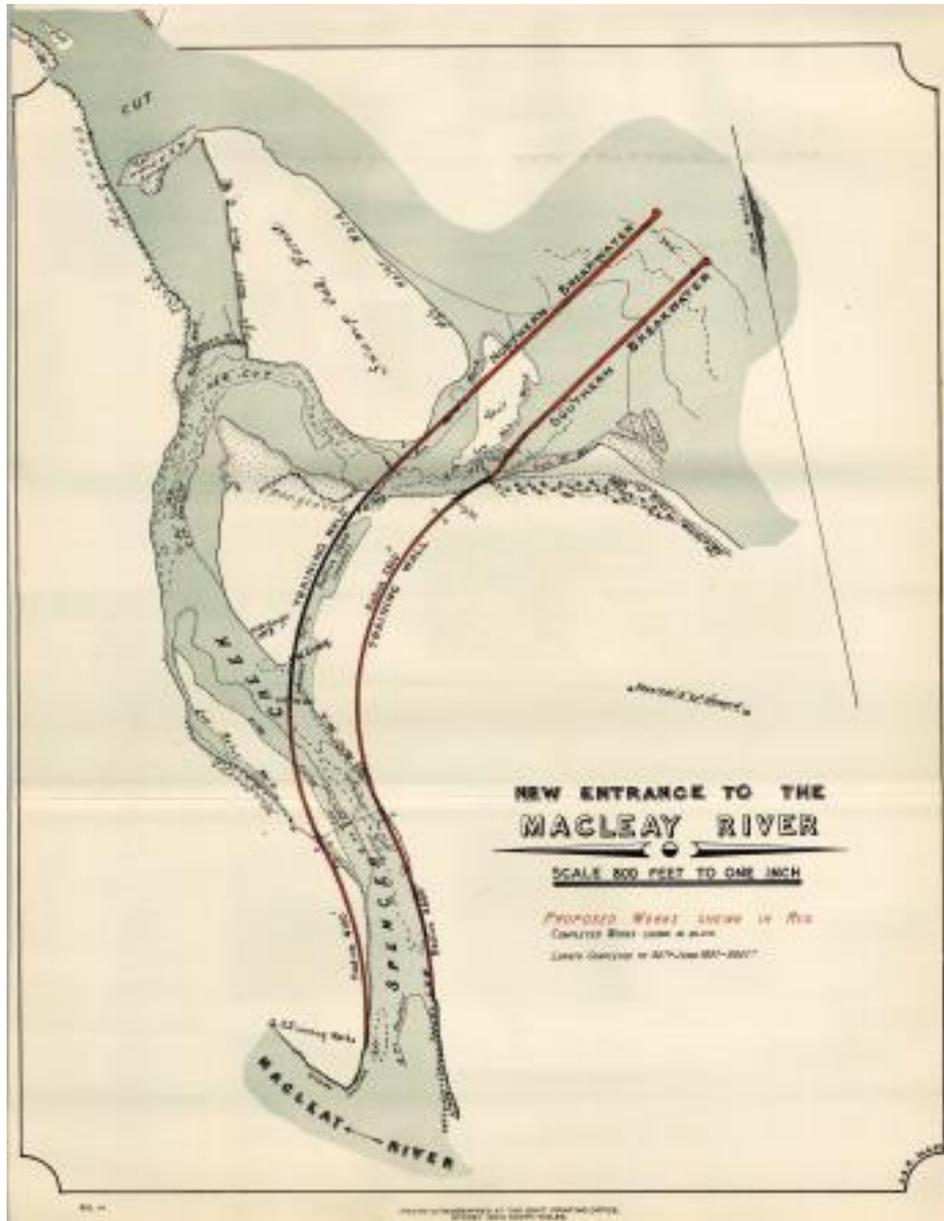


Figure 12: New Entrance Macleay River PWD 1898.

There is considerable information available to show that the Macleay River is not stable without human intervention, including the construction of training walls and dredging of sands at the entrance to the ocean. Without these actions the river in its natural state would be subject to frequent shoaling with tidal inhibiting entrance barriers. The actions are regarded as essential from a maritime safety point of view. The Macleay River may no longer be needed for commercial marine transport purposes, however safe access to the ocean is still required for fishing, tourism and environmental aesthetics including flood mitigation. Consequently, the title boundary positions should again be maintained fixed in the same positions into the future with no variation.

## 4 CONCLUDING REMARKS

Are our coastal waterways tidal? Many estuaries, bays, rivers and creeks that flow into the ocean are affected by bars and barriers formed by the build-up of sands that travel along the coast by the process of longshore or littoral drift. Prior to the development of road transport, coastal marine transport was essential to transport goods and services to and from towns up and down the NSW coast. Historical records of shipping delays and tragedies abound with these bars and barriers presenting significant safety hazards that required artificial works to train the entrances and dredge the sands in order to maintain safe navigation and the continued transport of people and goods. Even now after road transport has become the major carrier of people, goods and services, the waterways are maintained for many purposes including commercial and recreational fishing, tourism and aesthetics.

The waterways are physically tidal with either normal or limited tidal exchange. However, without human interference in the natural processes of sand transport, they may not be tidal due to the entrances only being intermittently opened or closed. All of the barrier affected waterways, including those where works have been undertaken, are therefore classed as ICOLLS.

Legislative rulings apply to ICOLLS:

- The boundaries for lands along lakes including ICOLLS are the banks as initially surveyed for titling purposes – Crown Land Management Act 2016.
- The definition in the S&SI Regulation may need legal clarification to understand the phrase “but does not include tidal waters”.
- Ownership of the beds of ICOLLS is held by the Crown.
- Section 28 of the Coastal Management Act 2016 – Modification of doctrine of erosion and accretion does not apply to ICOLLS.

Plan and title records can reveal information relevant to the nature of waterways, such as has been shown for Ettymalong Creek. Aerial imagery, and historical runs in particular, can reveal present and past conditions of waterways. Technical reports, including those associated with coast and estuary management, historical reports and published material (both hardcopy and online), provide evidence of the natural state of the coastal waterways and the human actions that have taken place since settlement.

The use of available resource material is essential for understanding the lands (and waters) that we survey for titling purposes:

- Classification of many coastal waterways for the purposes of survey and titling is that they are ICOLLS.
- Surveyors need to be aware of the tidal nature, now and in the past, of coastal waterways that abut land being surveyed.
- Human interference for the purposes of safety and economics is a significant aspect for our coastal waterways.

## GLOSSARY

The Coastal Management Glossary (NSW OEH, 2018) states:

- Coastal lake or lagoon: A coastal water body that is generally closed off from the sea by a sandy barrier. Water levels and water quality may be quite different to the nearby ocean.
- Estuary: According to the Coastal Management Act 2016, any part of a river, lake, lagoon or coastal creek whose level is periodically or intermittently affected by coastal tides, up to the highest astronomical tide.
- Intermittently closed and open lakes and lagoons (ICOLLs): Coastal lakes and lagoons where the entrance may be closed to the sea from time to time and for varying periods, by accretion of a berm. ICOLLs have sensitive water quality because they accumulate loads of sediment and nutrients from the catchment and may have poor water circulation and flushing. The most sensitive waterways listed in the State Environmental Planning Policy (Coastal Management) 2018 are all ICOLLs. The catchments of these lakes and lagoons are included in the coastal environment area.
- Lagoon: A shallow body of open water, partly or completely separated from the sea by a coastal barrier or reef, sometimes connected to the sea via an inlet.
- Littoral of or pertaining to a shore, especially of the sea: Often used as a general term for the coastal zone influenced by wave action, or, more specifically, the shore zone between the high and low water marks.
- Longshore transport (littoral drift): Refers to the sediment moved along a coastline under the action of wave-induced longshore currents. The net drift is the sum of the positive (conventionally northwards direction in NSW) and negative (southwards in NSW) direction. The gross drift is the sum of the drift magnitudes (absolute values). The differential drift is the difference between the net drift into and out of a coastal compartment. Both gross and net drift are typically averaged over a year and expressed in m<sup>3</sup>/yr.
- Maintenance dredging: The recurrent dredging of sediment from a waterway, including existing navigation channels, approaches and berths, to allow safe navigation by commercial or recreational boating traffic.
- Natural coastal processes: The coastal processes over which people have no control, such as wind, waves and tides.
- Riparian: Pertaining to the banks of a body of water, such as an estuary.
- Sand drift: The movement of sand by wind. On the coast, this generally describes sand movement resulting from natural or human-induced degradation of dune vegetation, resulting in either nuisance or major sand drift (dune transgression).
- Sediment transport: The process whereby sediment is moved offshore, onshore or along shore by wave, current or wind action.
- Tidal channel: A major channel followed by tidal currents, extending from offshore into a tidal marsh or a tidal flat; tidal inlet.
- Tidal delta: Where an inlet of a barrier estuary or open coastal lake is dominated by tidal processes, a flood tide delta develops inside the entrance, as tidal currents transport marine sand into the estuary. Ebb tide deltas may also occur, outside the mouth of an estuary.
- Tidal inundation: The inundation of land by tidal action under average meteorological conditions and the incursion of sea water onto low lying land that is not normally inundated, during a high sea level event such as a king tide or due to longer-term sea level rise.
- Tidal limit: The maximum upstream location on a watercourse at which a tidal variation in water level is observed.
- Training walls: Walls constructed at the entrances of estuaries and rivers to improve navigability.

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